

EDITORIAL

Hybrid imaging

State-of-the-art patient management frequently requires the use of non-invasive imaging methods to assess the anatomy, function or molecular-biological conditions of patients or study subjects. Such imaging methods can be singular, providing either anatomical or molecular information, or they can be combined & thus, providing “anato-metabolic” information. Combining anatomical and functional imaging within a single, hybrid imaging system or obtaining an “anato-metabolic image” was based on sophisticated software techniques. Imaging systems that combine two complementary imaging techniques within the same gantry (e.g., PET/CT, SPECT/CT) is known as “hardware fusion”, in contrast to the software fusion approaches mentioned above.

So, Hybrid Imaging is best defined as the fusion of two or more imaging technologies into a single, new form of imaging technique. Hybrid imaging modalities such as PET with CT or SPECT with CT are proving to be invaluable, as they provide information about both anatomy and function and thus typically, this new form is synergistic—that is, more powerful than the sum of its parts. Although some hybrid imaging modalities may be used purely to depict anatomy, the most exciting characteristic of hybrid imaging is its potential to show molecular processes in vivo within their larger anatomic context. The introduction of hybrid technology - positron emission tomography/computed tomography (PET/CT) and single-photon emission computed tomography (SPECT/CT) - has revolutionized the imaging world. This technology allows the combination of the exquisite anatomic details provided, for example, by CT, with the important and much needed functional, physiologic or metabolic information provided by molecular imaging. Hybrid imaging technology has the potential of providing “one-stop” imaging with increased specificity, attenuation correction and localization, thus providing more accurate diagnosis. The utility of PET/CT is established in clinical practice and has added significant value in

the areas of neurology, cardiology and oncology. In the area of cardiology, SPECT-CT technology decreases breast and diaphragm attenuation artifacts thus increasing its specificity by offering attenuation correction at minimum with lower-end systems. The higher-end SPECT-CT combines perfusion, function & coronary anatomy as well as coronary calcium measurement exemplifying the value of “one-stop” imaging.

Hybrid imaging modalities now in existence include ultrasonography with Magnetic resonance imaging (US/MRI), MR imaging/angiography, computed tomography (CT) / angiography, single photon emission computed tomography with CT (SPECT/CT), positron emission tomography (PET/CT) and in the pipeline PET/MR imaging. Most of these have the potential to aid the development of personalized, molecular medicine. As per the agreed Radiopaedia style guide, when two modalities are combined such as PET and CT, the two modalities are separated by a single dash only, i.e. PET-CT, PET-MRI, etc. However other formats like using forward slash (/) e.g. PET/CT or PET/MRI is also frequently used by many.

General benefits of hybrid imaging, the best of both words includes

- a. Improved specificity and accuracy by combining anatomy and function in one sitting, thus offering state-of-the-art and accurate diagnosis.
- b. A further step towards individualized medicine.
- c. Precise monitoring of interventional procedures.
- d. Reduced radiation exposure e.g. dynamic US after obtaining CT map.

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